REMARKS

Entry of the foregoing and reconsideration of the subject application are respectfully requested in light of the amendments above and the comments which follow.

Claims 1-32 were pending in this application, withdrawn claims 33-41 having been previously canceled by the Response submitted September 14, 2005. In this response, claims 1, 13, 19, 20, 22-25 and 27 have been amended and claim 26 canceled. Thus, claims 1-25 and 27-32 remain pending.

Support for the foregoing amendments can be found, for example, in at least the following locations in the original disclosure: the original claims.

CLAIM REJECTIONS UNDER 35 U.S.C. §112

Claim 2 has again been rejected under 35 U.S.C. §112, second paragraph. The Official Action alleges that the prior rejection was not addressed by the Applicant. This is incorrect. A detailed discussion of this rejection and the reasons why the claim is definite appears on page 7 of the prior filed Response. The arguments are not repeated here, but the Examiner's attention is directed to the appropriate section of the noted prior filed Response.

To the extent that this rejection has been improperly maintained because the Examiner has not noted or considered our prior reply on this point, Applicant respectfully asserts that the finality of this Office Action is improper. Accordingly, entry and consideration of this response is appropriate at least so that this prior addressed point can be resolved.

CLAIM REJECTIONS UNDER 35 U.S.C. §103

Claims 1-19 and 22-32 stand rejected under 35 U.S.C. §103(a) as being unpatentable over USP 5,348,694 to Goldberger (hereafter "*Goldberger*") in view of USP 6,417,126 to Yang (hereafter "*Yang*") and Shen et al., J. Am. Ceram. Soc., Vol. 85, Num. 8 pgs 1921-1927(2002) (hereafter "*Shen et al.*") on the grounds set forth at paragraph 4 of the Official Action. For at least the reasons noted below, this rejection should be withdrawn.

The present disclosure is directed to methods for producing cutting tool inserts, whereby specific requirements, such as tool life and notch wear (see [0023] and [0052] of the present invention), are to be met. These properties are greatly enhanced by the presently claimed method, comprising the steps of:

> milling and mixing powders of alumina and silicon carbide whiskers;
> forming said mixture into a preformed workpiece;
> heating said workpiece at a heating rate of from about 20 to about 60 °C per minute to a sintering temperature of between from about 1600 to about 2300 °C; and
> holding said workpiece at said sintering temperature for a holding time of from about 5 to about 60 minutes at a pressure of between 20 to 100 MPa,
> wherein said alumina grain size in said composite material has an 80^{th} percentile (P80) of less than 2.5μm.

The above features are not present, either alone in any one cited reference or in the proposed combination of Goldberger, Yang and Shen et al. and, therefore, the rejection based on prima facie obviousness is improper as not disclosing, teaching or suggesting all of the features of the claims. The following matrix shows the parameters of the claimed method compared to the methods in the cited references:

Feature	US 10/763,260	Goldberger	Yang	Shen et al.
Heating Rate	20 to 60 °C/min	> 50 °C/sec	1 to 5 °C/min 1 to 10 °C/min 1 to 20 °C/min (stepwise)	150 to 200 °C/min
Sintering Temperature	1600 to 2300 °C	1000 to > 2000 °C	500 °C 1250 to 1600 °C 1600 to 1900 °C (stepwise)	1175 to 1600 °C
Holding Time	5 to 60 min	several seconds	10 to 120 min	0 to 40 min
Holding Pressure	20 to 100 MPa	7 to 14 MPa	pressureless	50 to 200 MPa
P80 of Alumina	less than 2.5 μm	---	---	---

Reviewing the above table, at least the heating rate feature and the P80 of Alumina feature are not disclosed, taught or suggested by in any one or a combination of the cited references. Therefore, the claimed method may not be rendered obvious by any of the cited references, alone or in combination.

Comments on the specific cited references followed by a discussion of the Examiner's application of these references and follows:

Goldberger: *Goldberger* aims at achieving essentially complete densification at extremely rapid processing rates (see column 1, lines 19 to 21). Also, *Goldberger* intends to provide a means for extremely rapid sintering under pressure to achieve consolidated parts of low porosity and having a flaw-free and ultra-fine grain structure (column 4, lines 17 to 20).

In order to achieve his stated goals, *Goldberger* applies the following parameters:

- temperatures of about 1000 °C to about 2200 °C (see column 6, lines 61 to 66);

- pressures of about 1000 psi to about 2000 psi, which equals 7 MPa to about 14 MPa (see column 7, lines 29 to 31);
- temperature rise rates in excess of 50 °C per second (see column 3, lines 38 to 42); and
- a limit of the time at temperature (holding time) to no longer than several minutes, and possibly to residence times of no more than several seconds (see column 3, lines 39 to 44, example 2, example 3, and table 2).

In contrast to *Goldberger*, the present claims recite a higher pressure of 20 to 100 MPa, an extremely lower heating rate of 20 to 60 °C/min, and longer holding times of 5 to 60 min.

Further, according to the present claims, the alumina grain size in said composite material has an 80th percentile (P80) of less than 2.5 μm, which surprisingly resulted in an improved performance of the produced cutting tool inserts. Nothing is disclosed by *Goldberger* in respect of the alumina grain size distribution, nevertheless the 80th percentile of any such distribution.

Yang: *Yang* provides a process for producing ceramic composites wherein, for any particular composite, the relative densities are about 97% or more of the theoretical density (see column 1, lines 15 to 18). *Yang* uses the parameters of no pressure, as the sintering is performed in a crucible with a tight lid (see column 12, line 63).

Further, *Yang's* heating is conducted stepwise, applying heating rates of 1 to 5 °C per minute, 1 to 10 °C per minute, and 1 to 20 °C per minute; and the temperatures applied are 500 °C, 1250 to 1600 °C, and 1600 to 1900 °C respectively (see column 3, lines 47 to 55), whereby the preform is maintained at the temperature of 1600 °C to 1900 °C for a holding time between about 10 to 120 minutes (column 3, line 55). Thus, the heating rates as well as the pressure taught by *Yang* are much lower than in the method of the present claims. Also the method of *Yang* and the method of present claims are essentially not comparable.

Shen et al.: *Shen et al.* aims at providing a method with very fast heating rates, compared to *Yang*, and very short heating rates, compared to *Goldberger*, and still

much faster heating rates than the presently claimed method (*Shen et al.*, page 1921, column 1, § 3).

The method of *Shen et al.* is plasma spark sintering. The temperature range tested by *Shen et al.* stretches from 1175 to 1600 °C, applying a pressure from 50 to 200 MPa, using heating rates of 150 to 200 °C per minute and holding times between 0 and 40 minutes. Thus, the temperature range and the heating rates of *Shen et al.* are outside the present claims.

In order to minimize grain growth, *Shen et al.* recommends to apply lower temperature, higher heating rate, shorter holding time, lower pressure and increased pulse on/off ratio (see entire document). To minimize (optimize) the grain growth, the sintering temperature and the heating rate recommended by *Shen et al.* even further move away from the present claims. Thus, the method of the present invention and the method of *Shen et al.* are not comparable. To optimize a low grain growth, *Shen et al.* teaches away from the parameters of the present claims.

Response to Examiner's Rejection and Other Non-Obviousness Considerations

1. Not all features are disclosed, taught or suggested

In table 3 on page 12 of the present application, it is clearly shown that neither density nor hardness, fracture toughness or strength contribute to making the present method especially valuable for producing cutting tool inserts. Rather, it is shown in table 1 and table 2 that through the present method, an increased tool life and a reduction in notch wear is achieved. Until the disclosure of the present application, it is not entirely clear why two materials with almost identical physical and mechanical properties exhibit considerable large differences in cutting performance. However, the disclosure and claimed method make it clear that the microstructural effects of a narrow alumina grain size distribution produces the desired, novel and non-obvious effect.

One of these effects unique to the material produced by the present invention is a very narrow alumina grain size distribution, which is determined by the 80th percentile of the width of the alumina grain sizes. The fact that not only the mean alumina grain size is rather low but also that the alumina grain size distribution is very narrow, which is

expressed by P80 of less than 2.5 micrometers, provides features to the composite material that contribute to enhancing cutting tool performance. Thus, methods to incorporate alumina of P80 less than 2.5 micrometers are likewise unique.

However, a narrow alumina grain size distribution is not achieved through common methods of adjusting temperature, heating rate, etc. to simply achieve small grain sizes, as described in *Goldberger*, *Yang*, or *Shen et al.* Each of these references use parameters for deriving small grain sizes that differ widely between the aforementioned methods. Further, the present method tends to use parameters that have been described to be unfavourable in order to obtain small grain sizes by the aforementioned authors. Furthermore, the noted parameters in the cited references are not sufficient themselves to produce the claimed alumina grain size distribution.

For at least the above noted reason, the present claims are not obvious in view of the cited references because the disclosure in the cited references does not disclose, teach or suggest all of the features of the present claims.

2. Some of the references in the proposed combination teach away from each other and therefore there was no motivation to combine their teachings

The skilled person would never have combined the teachings of *Yang* and *Goldberger*, because these teachings are completely opposite to each other. *Yang* teaches <u>pressureless</u> sintering, whereas the method of *Goldberger* requires a pressure of 7 to 14 MPa. *Yang* teaches a <u>stepwise slow</u> heating regimen, whereas the method of *Goldberger* requires an <u>extremely rapid</u> heating ramp of more than 50 °C per <u>second</u> to achieve consolidated parts of low porosity having a flaw-free and ultra-fine structure. Moreover, <u>pressureless</u> sintering has been stated to be <u>unfavourable</u> by *Goldberger* (see, e.g., col. 3, lines 9-59 of Goldberger in contrast to the disclosure in Yang). Thus, *Yang* and *Goldberger* teach in opposite directions, and it would not be obvious to pick single parameters out of one document to combine it with other single parameters of the other document.

Furthermore, *Goldberger* itself discusses how the parameters for pressureless sintering are very different from that of pressure sintering, requiring different forms of

starting materials and being suitable for forming different end products. In other words, the disclosures and teachings in *Goldberger* and *Yang* are divergent.

For at least this further reason, the rejection should be reconsidered and withdrawn.

3. There is a general lack of motivation to combine the references as proposed, or at least there is selective combination, suggesting hindsight reconstruction

Each of *Goldberger*, *Yang* and *Shen et al.*, aim at providing high density products, and *Goldberger* as well as *Shen et al.* aim at a reduced grain size. However, it is clear from the present application (e.g., page 12, table 3), that an increased density is not the only result of the method, as the cutting tool density derived with the rapid sintering method is essentially the same as the one derived with a conventional method (hot pressing). Again, the inclusion of at least the P80 of alumina in the claimed method provides an inventive feature.

It is clear from *Shen et al.*, that reduced grain size results in higher hardness (see table 1 and the entire document). However, it is well known that hardness and fracture toughness are inversely related. A decrease of grain size to increase the hardness of a material will inherently lead to a decrease of the fracture toughness. As fracture toughness is a very important feature of cutting tool inserts, this effect is not desired in the presently claimed method.

Another important property for metal cutting is the thermal shock resistance, which is also directly linked to the fracture toughness. A high thermal shock resistance is necessary to withstand thermal fluctuations during intermittent cutting without cracking or fracturing and even higher demands are put on thermal shock resistance when using a cutting fluid.

With the above points in mind, it is clearly not obvious to a person skilled in the art to select an ultra-fine grain size as the optimal choice for a cutting tool's microstructure, since it is well-known that many properties essential for a good performance will be impaired. Therefore, the present invention did not aim at an

increased density and hardness through grain size reduction. However, the combination of features from the cited references clearly aim at an increased density and increased hardness through reduction of grain size.

Thus, any attribution to these references of all of the features of the claim necessarily uses hindsight to navigate the deleterious effect of the disclosures to arrive at Applicant's claims. Such hindsight reconstruction is improper. Accordingly, for at least this reason, reconsideration and withdrawal of the rejection is requested.

4. Even if properly combined, there is a missing element

For one of ordinary skill, it would have not been obvious to combine the references by *Goldberger*, *Yang* and *Shen et al.*, as these documents disclose substantially different methods. Even if those documents would have been considered meaningful in the context of the field of the invention, the skilled person would not have chosen the heating rates of the present claims, as both *Goldberger* and *Shen et al.* clearly teach away from such low heating rates. The teaching of *Yang* could also not render the heating rates of the present invention obvious, because *Yang* applies much lower heating rates than the present claims.

For at least this further reason, reconsideration and withdrawal of the rejection is appropriate.

Claims 20-21 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Goldberger in view of Yang and Shen et al. and further in view of USP 5,418,197 to Brandt (hereafter "*Brandt*") on the grounds set forth at paragraph 5 of the Official Action. For at least the reasons noted below, this rejection should be withdrawn.

Brandt does not disclose any method and does not disclose the missing features from the proposed combination of *Goldberger*, *Yang* and *Shen et al.* Therefore, *Brandt* does not contribute to overcome the deficiencies noted in the above combination applied to reject the independent claim and similar is inadequate to reject the dependent claims rejected here. Reconsideration and withdrawal is requested..

CONCLUSION

From the foregoing, further and favorable action in the form of a Notice of Allowance is earnestly solicited. Should the Examiner feel that any issues remain, it is requested that the undersigned be contacted so that any such issues may be adequately addressed and prosecution of the instant application expedited.

Respectfully submitted,

DRINKER, BIDDLE & REATH LLP

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